

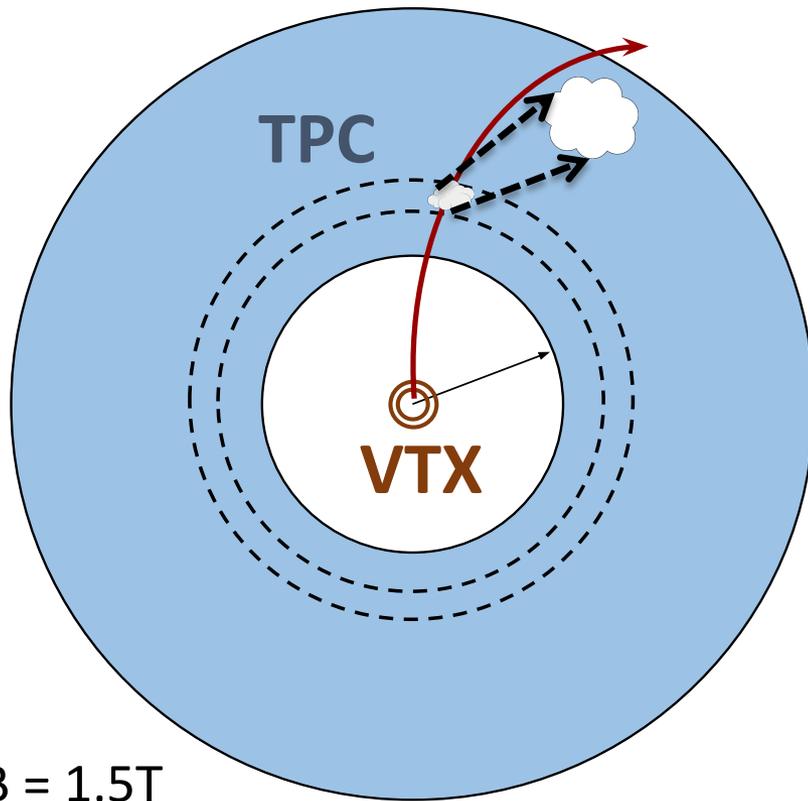
# TPC pre-CDR Simulations

- Evaluate cost/benefit to add TPC to sPHENIX
- Initial goal – optimize channel count (pad-size), inner radius, drift gas & E-field
- To get working on rcf
  - git clone coresoftware & macros from sPHENIX-Collaboration
  - cd coresoftware; git checkout TPC; git pull (same for macros)
  - make install g4main, g4detectors, g4evan to \$MYSPHENIX
  - prepend \$MYSPHENIX to \$LD\_LIBRARY\_PATH (after setup)
  - cd macros; root -b Fun4All\_G4\_tpc\_plus\_vtx\_Ups.C
    - almost (all) constants adjusted at top of macro
    - output saved to g4\_eval\_ups\_1.root
  - see talk by Alan for more & plans to merge branches

# TPC default parameters

## A sPHENIX Tracking Solution: TPC & 2 Pixel Layers

Design parameters and performance consistent with ILC TPC prototypes



### TPC

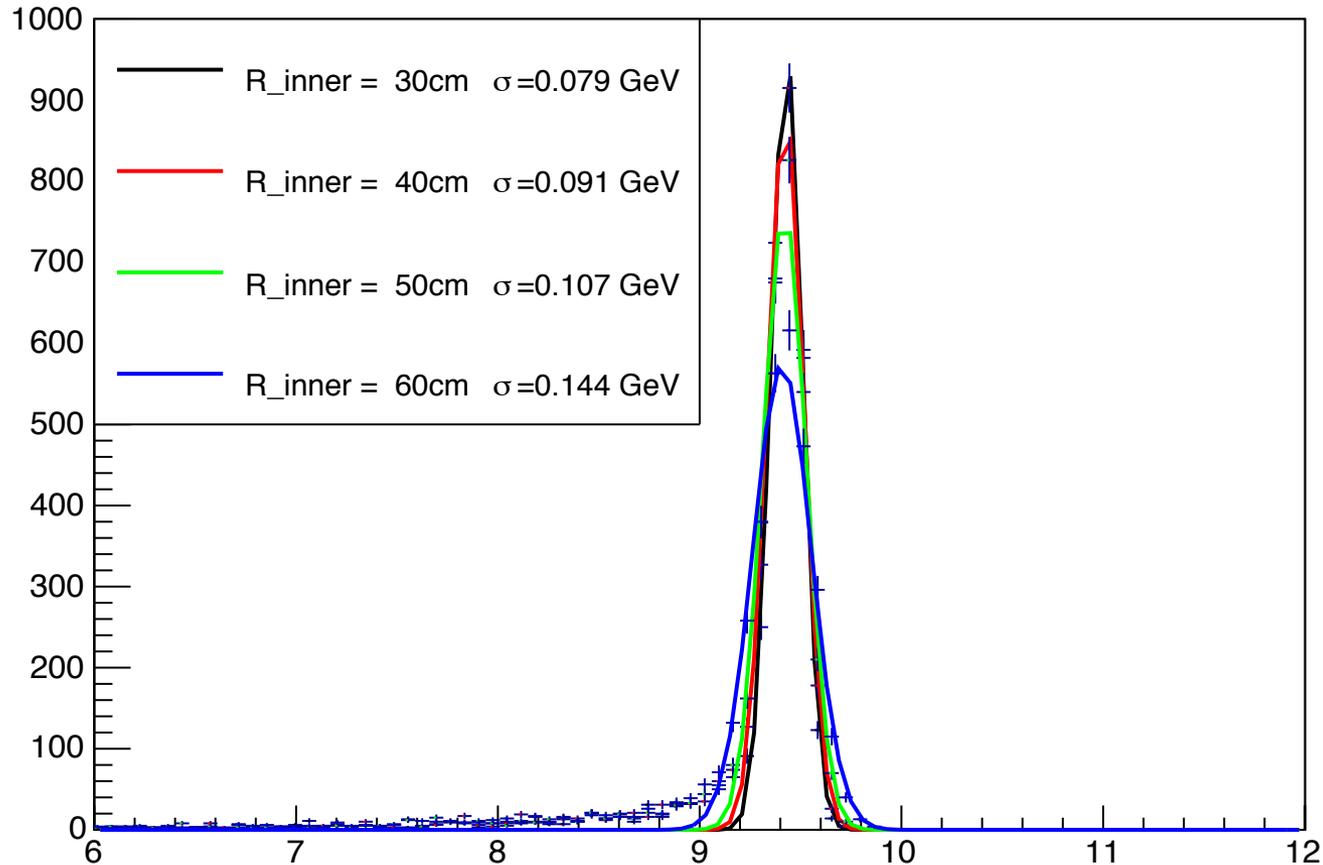
- T2K gas volume from 30cm to 80cm
- $|y| < 1 \rightarrow z_{\max} \sim \pm 80\text{cm}$
- 60 radial readout layer with  $\Delta r \sim 8\text{mm}$
- Readout plane with 1.2mm pads in  $r\phi$ 
  - approximately 350,000 readout channel
- Assume 40 MHz FADC  $\rightarrow \Delta z \sim 2\text{mm}$ 
  - approximately 400 samples per readout channel

### VTX layers 1 & 2

- Silicon tracker design
  - Si layers at (2.7, 4.6) cm
  - T2K gas,  $E=220\text{ V/cm}$

# First study $R_{\text{inner}}$ w/ npoints fixed

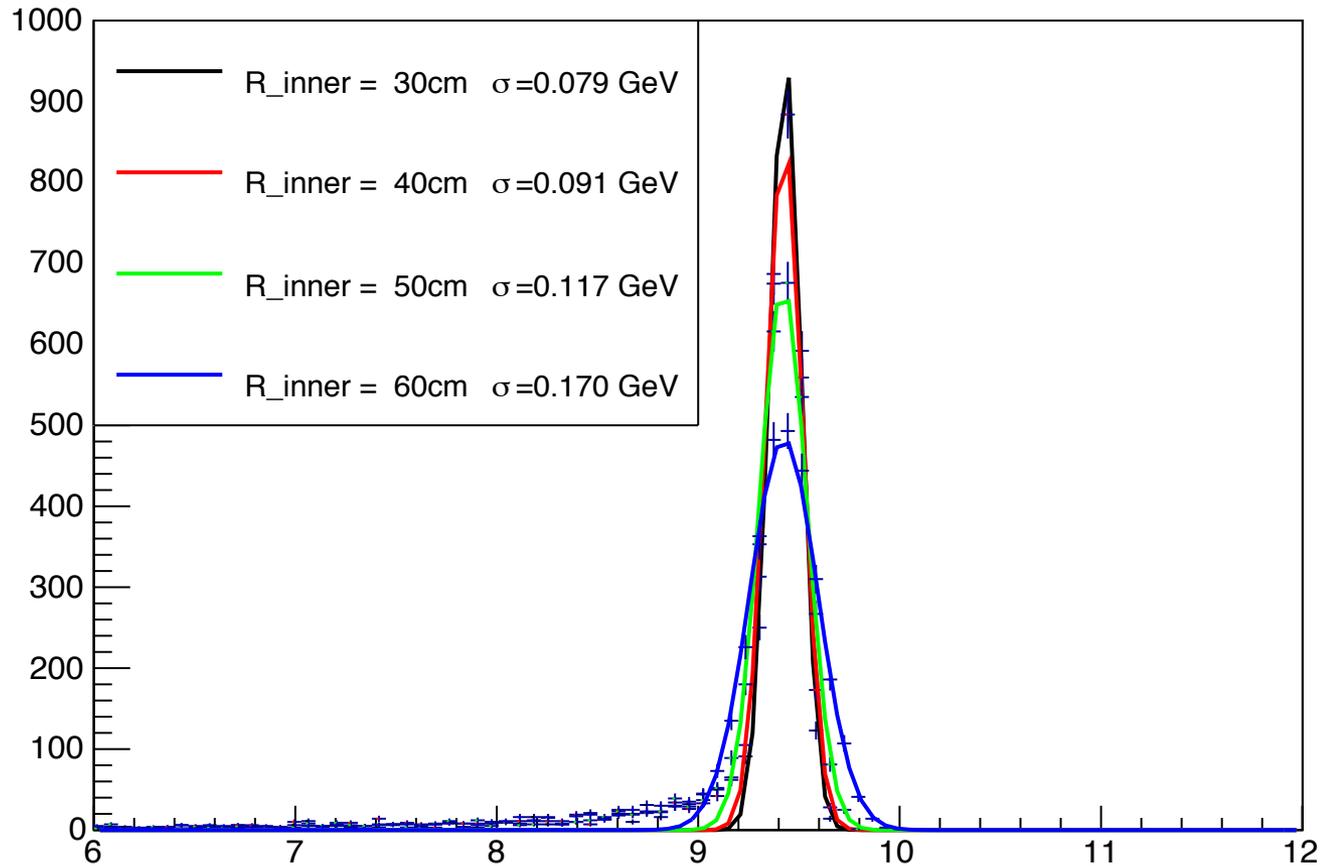
TPC+2Si Upsilon Width, npoints=60



- Upsilon width increase after  $R_{\text{inner}} > 50$  cm

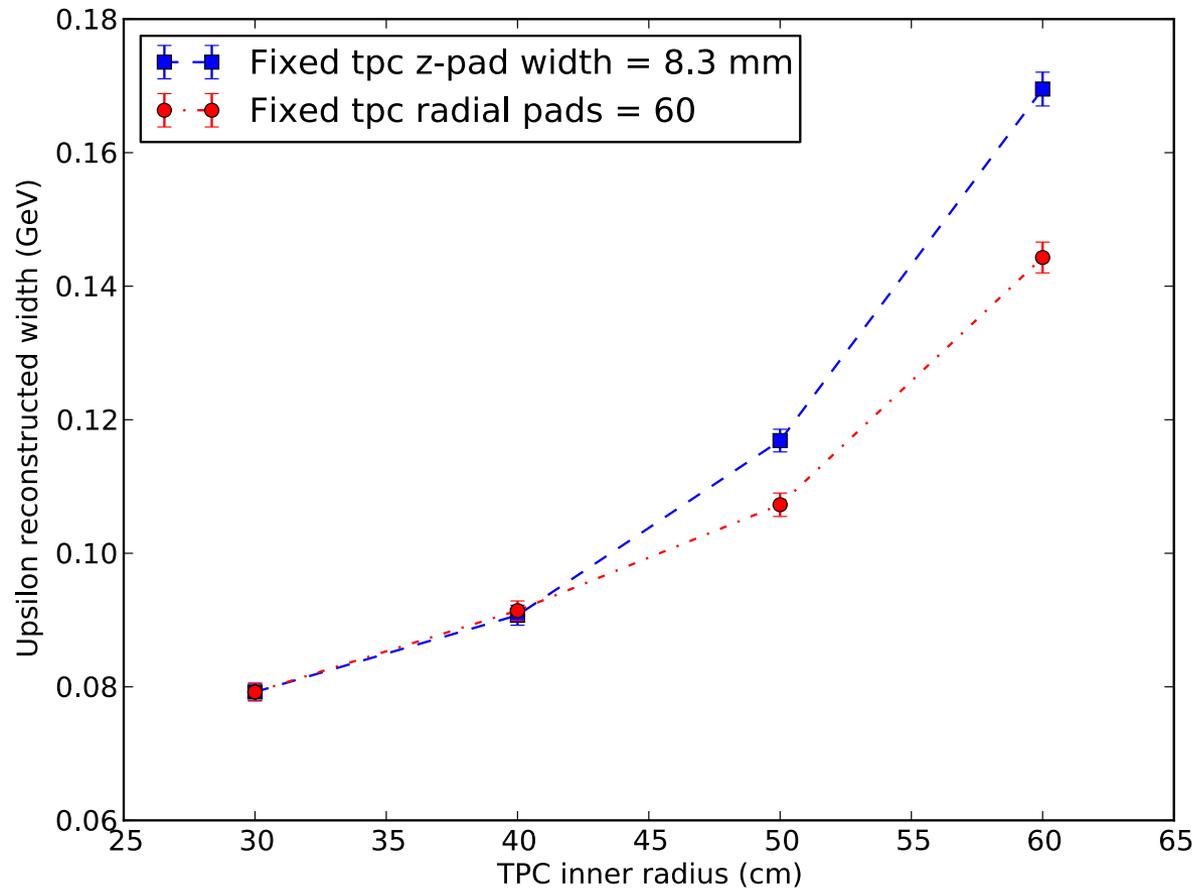
# $R_{\text{inner}}$ w/ zpad fixed at 8.3 mm

TPC+2Si Upsilon Width, zpad=0.83 cm



- Upsilon width increase for  $R_{\text{inner}} > 40\text{ cm}$

# R<sub>inner</sub> Comparison



- Preliminary default result to be revisited many times !

# Next Steps : Figure list for pre-CDR

- Single particle simulations
  - $\Delta p/p$  and  $\Upsilon$ -width vs. inner radius
  - $\Delta p/p$  and  $\Upsilon$ -width vs. x-y pad size
  - Repeat for several Gas- $E_{\text{field}}$  choices
    - T2K(Ar-CF4-Iso), P10(Ar-Iso), ALICE(Ne-CO2-N2), CF4
- Hijing environment
  - Efficiency vs. multiplicity (for single-track optimum)
  - Resolution vs. multiplicity (for single-track optimum)
  - Signal-noise improvement with  $dE/dx$ 
    - vs. Gas- $E_{\text{field}}$  and  $R_{\text{inner}}$